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TITLE : SOLDER AND METHOD OF MOUNTING ELECTRONIC PARTS

ABSTRACT : PROBLEM TO BE SOLVED: To improve thermal fatigue property of a soldered part in comparison with addition of Cu alone by adding not more than a specific quantity of at least P or B to the composition consisting of a specific weight % each of Sn, Cu, and Pt and the balance Pb.

SOLUTION: The solder is constituted in weight% of 5.0-95.0 Sn, 0.1-3.0 Cu, 0.05-2.0 Pt and the balance Pb, with at least P or B added by 0.3 pts.wt. or less against total 100 pts.wt. The mounting method of electronic parts is such that electronic parts having electroless Ni plated surface particularly silicon chips and substrate mounted with other electronic parts are connected with the solder. The reason of making an Sn-Pb system as the base is that it can be used in mounting semiconductor parts having low heat resistance. In addition, even if the surface to be jointed is an electroless Ni plated surface, it can be soldered appropriately.

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[Claim(s)]
[Claim 1] Solder characterized by for Cu becoming in Sn and the remainder consisting of Pb 0.05 to 2.0weight % 0.1 to 3.0weight % 5.0 to 95.0weight % in Pt.
[Claim 2] Solder characterized by the thing of P or B for which either is added at least below as for 0.3 weight part at the presentation 100 weight part which Cu becomes 5.0 to 95.0weight % in Sn, and the remainder turns into from Pb 0.05 to 2.0weight % 0.1 to 3.0weight % in Pt.
[Claim 3] Solder according to claim 1 or 2 used for soldering of non-electrolyzed nickel plating side.
[Claim 4] The mounting method of the electronic parts characterized by connecting the electronic parts which have non-electrolyzed nickel plating side, and the substrate which mounts these electronic parts with solder according to claim 1.
[Claim 5] The mounting method of the electronic parts characterized by connecting the electronic parts which have non-electrolyzed nickel plating side, and the substrate which mounts these electronic parts with solder according to claim 1.
[Claim 6] The mounting method of electronic parts according to claim 4 or 5 that electronic parts are silicon chips.

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention is useful although electronic parts, such as IC, are mounted in a wiring board about solder.

[0002]

[Description of the Prior Art] The small size of these days and an electrical and electric equipment, a thin shape, a light weight, and multi-functionalization, Are remarkable in personal youths, such as PHS, a car-navigation system, a video camera, and a notebook personal computer. In order to accelerate the miniaturization of electronic parts, composite-izing, advanced features, and the densification of surface mounting in connection with this and to cope with growth in the calorific power of an electronic circuit plate, and severe-ization of a service condition, much more improvement of reliability to the thermal fatigue of the soldering part of electronic parts is demanded. It is well-known to add Cu, in order to use Sn-Pb system solder in many cases, to make soldering of electronic parts reinforce the mechanical strength of the soldering part in order to cater to the claim mentioned above, and to raise heat-resistant fatigue nature.

[0003]

[Problem(s) to be Solved by the Invention] nickel may be plated to the land of a wiring board, or a lead and land of a semiconductor package for corrosion prevention, and that plating may be performed to them by electroless deposition in this case. For example, in BGA (ball grid array), it is well-known to perform nickel plating of the land which anchors a solder ball by electroless deposition, and to attain micrifying of a land, abatement of manday, and low cost-ization. However, even if it solders non-electrolyzed nickel plating side with the Sn-Pb system solder which added Above Cu, particular improvement in heat-resistant fatigue nature cannot be obtained.

[0004] When the cause is investigated wholeheartedly, in this invention person At then, the time of a deposit of nickel film It became clear that it was the result of P and B of a reducing agent [Na2H2PO2, KH2PO2, NaBH4, 2 (CH3) NH-BH3] in non-electrolyzed nickel plating bath carrying out eutectoid, containing on the deposit nickel film, and the vulnerable phosphide and the boride of Sn being generated by the joining interface during progress of a heat history. The object of this invention is to raise the heat-resistant fatigue nature of a soldering part much more compared with the case of Cu independent addition in the solder of a Sn-Pb system.

[0005]

[Means for Solving the Problem] The solder concerning this invention is architecture characterized by for Cu becoming in Sn and the remainder consisting of Pb 0.05 to 2.0weight % 0.1 to 3.0weight % 5.0 to 95.0weight % in Pt, and to 100 weight parts, even if there is little P or B, below 0.3 weight part can add either. The mounting method of the electronic parts concerning this invention is architecture characterized by connecting the electronic parts which have non-electrolyzed nickel plating side, especially a silicon chip and the substrate which mounts these electronic parts with the above-mentioned solder.

[0006] In the solder concerning this invention, it is [of having used the Sn-Pb system as the base] reasonable in enabling it to use it also for mounting of heat-resistant low semiconductor components. In the solder concerning this invention, whether a plane of composition is non-electrolyzed nickel plating side or P and B which are a reducing agent component in non-electrolyzed nickel plating bath

are carrying out eutectoid into the deposited metal film, it can solder suitably. In the solder concerning this invention, the Reason for having made Sn into 5 to 95 weight % is for securing the wettability and breadth nature to a plane of composition. The Reason for adding Cu is synergism with Pt mentioned later, and is for making Sn and an intermetallic compound form by shift near [concerned] the joining interface of Cu, suppressing generation of the phosphide of Sn, or boride, and controlling lowering of junction hardness, while reinforcing the mechanical strength of solder and raising heat-resistant fatigue nature. [the Reason for making the addition of Cu into 0.1 weight % - 3.0 weight %] If it is hard to attain these improvement / inhibition effects to satisfaction and 3.0 weight % is exceeded at less than 0.1 weight % It is because liquidus temperature becomes high (250 degrees C or more), and safe soldering of semiconductor components becomes difficult and lowering of the mechanical strength of a joining interface is invited for superfluous-izing of the amount of intermetallic compounds with Sn. The Reason for adding Pt is synergism with Above Cu, and the mechanical strength of solder is reinforced. It is for making shift near [concerned] the joining interface of Pt generate phosphide and boride more preferentially than Sn, suppressing generation of the phosphide of Sn, or boride, and controlling lowering of junction hardness, while raising heat-resistant fatigue nature. [the Reason for making the addition of Pt into 0.05 weight % - 2.0 weight %] At less than 0.05 weight %, a dominance difference is substantially lost compared with the case where enhancement of a mechanical strength and improvement in heat-resistant fatigue nature are Cu independent addition. Moreover, it is because cost will become high too much, and liquidus temperature will become high (250 degrees C or more), and safe soldering of semiconductor components will become difficult and flowability will also fall, if generation of the phosphide of Pt or boride becomes small, cannot attain lowering inhibition of junction hardness easily to satisfaction and exceeds 2.0 weight %.

[0007] [the Reason for adding P or B] in the solder concerning this invention The phosphide and boride of Sn are made to generate beforehand in solder before junction to non-electrolyzed nickel plating film containing P or B. It is in controlling that a compound with P and B which are contained in non-electrolyzed nickel plating film generates to a joining interface, and controlling lowering of junction hardness during progress of the heat history of the time of soldering, or after that. The Reason for below 0.3 weight part carrying out the addition of P or B is that the embrittlement of about [becoming expensive] and solder will be invited if 0.3 weight part is exceeded.

[0008]

[Embodiment of the Invention] If the solder concerning this invention is within the limits which can maintain the operation effect of invention substantially, where an impurity is included, it can be used. ** and the chemical entity of Class A specified to the JIS Z 3282-1986-table 3 is followed. Containing As and containing Cd in 0.005 or less weight % of the range 0.03 or less weight % 0.005 or less weight % is permitted [Fe / aluminum] 0.03 or less weight % 0.003 or less weight % in Zn.

[0009] The solder ball which uses the solder concerning this invention for formation of the solder bump in the land in BGA, CSP (chip size ******-**), etc. which carried out non-electrolyzed nickel plating of the land, The solder bath used when it mounts electronic parts, such as a silicon chip, in a

wiring board by the flow-of-metal soldering method, It can be used also as rod-like solder, line solder, ribbon-like solder, preforming-like solder, and resin flux cored solder outside the solder powder of the cream solder used when it mounts electronic parts in a wiring board by a reflow-soldering method.

[0010] In a solder bump's formation in Above BGA The ball (usually a diameter of 1000-500 micrometers) of the solder concerning this invention can be carried in non-electrolyzed nickel plating land (diameters are mist and smallness from the above-mentioned ball diameter) of BGA with flux, a solder ball can be fused by a reflow, and it can form in a bump. Thus, in order to mount BGA in which the bump was formed Flux or solder paste is printed to a wiring board, temporarily fixing of the bump of BGA is carried out to this printing flux or printing solder paste, a bump is fused by a reflow, subsequently it cools, solder is solidified, and mounting is ended now. Non-electrolyzed nickel plane of composition which uses the solder concerning this invention can also plate Sn, Pd, Au, etc. on the surface, in order to improve wettability of solder, if it is within the limits which can maintain the effect of this invention substantially.

[0011]

[Example]

[Example 1] What performed non-electrolyzed nickel plating was made the land of BGA (land pitch 1.5mm, the land outside diameter of 700 micrometers, land number 15x15) with the plane of composition. In solder, 5 weight % of Sn, 0.5 weight % of Cu(s), 0.2 weight % of Pt(s), Use Remainder Pb, prepare a solder ball 800 micrometers in diameter with this solder, this solder ball is made to adhere to non-electrolyzed nickel plating land of Above BGA in flux, and it is a reflow at temperature with an inside of an inert atmosphere, and a liquidus temperature of +50 degrees C. The bump was formed. This bump formation BGA was joined to the wiring board by a reflow at temperature with a liquidus temperature of +50 degrees C among the inert atmosphere. When this sample was aged in 150 degree-Cx 100 hours and the tensile test was done using the load-push-pull gage with pull velocity of about 1mm/sec, and the test temperature of 25 degrees C, initial tensile strength and after-aging tensile strength were as in Table 1. Moreover, the pull fracture after aging was fracture from the core of a solder.

[0012]

[Table 1]

表 1

		実施例						
		1	2	3	4	5	6	7
組成	Sn (重量%)	5	95	63	63	63	63	63
	Cu (重量%)	0.5	0.5	0.1	3.0	0.5	0.5	0.5
	Pt (重量%)	0.2	0.2	0.2	0.2	0.05	2.0	0.2
	P (重量%)	-	-	-	-	-	-	0.01
	B (重量%)	-	-	-	-	-	-	-
	Pb (重量%)	残部	残部	残部	残部	残部	残部	残部
初期引張り強度(kgf/mm²)(A)		1.29	1.31	1.37	1.54	1.43	1.58	1.73
エージング後引張り強度(kgf/mm²)(B)		1.24	1.21	1.26	1.43	1.29	1.45	1.57
B／A×100%		96	92	92	93	90	92	91

		実施例			比較例			
		8	9	10	1	2	3	4
組成	Sn (重量%)	63	63	63	63	63	63	63
	Cu (重量%)	0.5	0.5	0.5	-	-	0.5	-
	Pt (重量%)	0.2	0.2	0.2	-	-	-	0.2
	P (重量%)	0.3	-	-	-	-	-	-
	B (重量%)	-	0.01	0.3	-	-	-	-
	その他 (重量%)	-	-	-	-	Ag2	-	-
	Pb (重量%)	残部	残部	残部	残部	残部	残部	残部
初期引張り強度(kgf/mm²)(A)		1.64	1.75	1.68	1.19	1.07	1.39	1.23
エージング後引張り強度(kgf/mm²)(B)		1.54	1.61	1.56	0.52	0.59	0.81	0.72
B／A×100%		93	92	93	44	55	58	58

[0013] [Example 2-8] It was presupposed that it is the same as an example 1 except having used as solder the thing of the presentation shown in Table 1. When it aged on the same conditions as an example 1 and the tensile test was done, initial tensile strength and after-aging tensile strength were as in Table 1. Moreover, which example of the pull fracture after aging was fracture from the core of a solder. In addition, aging pull fracture of the junction to the electrolysis nickel plating side of Sn-Pb system solder is fracture from the core of a solder, and the pull fracture of fracture of each above-mentioned example after aging corresponds with this fracture condition.

[0014] [Comparative example 1-4] It was presupposed that it is the same as an example 1 except having used as solder the thing of the presentation shown in Table 1. When it aged on the same conditions as an example 1 and the tensile test was done, initial tensile strength and after-aging tensile strength were as in Table 1. Moreover, although the pull fracture after aging was fracture from the core of a solder in the comparative example 4, all others were fracture from a joining interface.

[0015]

[Effect of the Invention] Although Cu or Pt independent addition can also increase initial tensile strength from comparison with a comparative example 1 and a comparative example 3 or 4, In this independent addition, it is in the tensile-strength retention after aging, or is 60%. With the solder concerning this invention which has added both Cu and Pt, sufficient heat-resistant fatigue characteristics of the growth in initial tensile strength and 90% of the tensile-strength retention after aging can be guaranteed to heat-resistant fatigue characteristics being inadequate. It is clear that it can prevent these outstanding heat-resistant fatigue characteristics and that the phosphide and boride of Sn weak against a soldering interface generate since a fracture condition as well as the time of nickel junction for an electrolysis is generated from the core of solder. Therefore, if electronic parts are mounted using the solder concerning this invention, even if it solders electronic parts to non-electrolyzed nickel plating side, sufficient joining reliability and stability can be guaranteed.

[Translation done.]